Music Technologies Group

MTG Pro One TurboCPU
CV (DAC) Installation Guide

Version 1.41 (Beta)
November 2015

CONTENTS

1: Introduction 3

Precautions! 3

2: Installation 4

Tools and Parts Required for CV 4
DAC Chip Installation (if required) 4
Block Diagram 6
DAC Wiring Summary 6
Step 1. CPU-to-CV Hookup 7
Step 2. OSC A and OSC B 7
Step 3. CV2: $VOUT_B$ to Filter Cutoff 10
Step 4. CV3: $VOUT_C$ to Filter Resonance 11

3: Using the CV/DAC Option 12

Appendix A: Firmware Upgrade using the PC App 13

Appendix B: Firmware Upgrade using MIDIOX 15

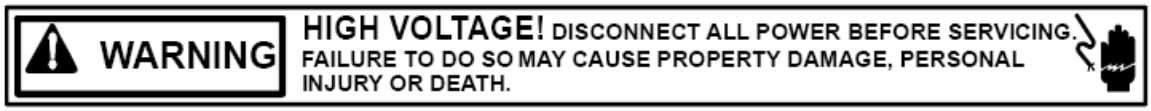
Configure MIDIOX 15
Prepare the Pro One for Download 16
Test the Communication 16
Firmware Upgrade 17

1: Introduction

The CV (control voltage) DAC (digital-to-analog converter) is an inexpensive do-it-yourself option that allows for greater control of the Pro One from an external MIDI device (keyboard, sequencer, etc.). While the installation is fairly simple (much easier than the MIDI board for instance), it still requires some electronics knowledge and soldering skills. Improper installation could damage your Pro One. We accept no responsibility for the work you perform on your Pro One. Read over the following installation description and if you feel you are not capable of the work required, turn the project over to a qualified technician.

Note: The elements are all controlled by MIDI so MIDI circuitry is required for the CV module to operate. This option requires TurboCPU firmware v1.10 or newer.

Precautions!



High Voltage Safety Warning

Turn the Pro One power switch OFF and disconnect the AC power cable before opening the Pro One.

ESD Precautions and Proper Handling Procedures

You should observe standard static-safe handling behavior when working with sensitive electronic equipment such as synthesizers:

- Avoid carpets in cool, dry areas.
- Dissipate static electricity before handling any system components by touching a grounded metal object.
- If possible, use anti-static devices, such as wrist straps and floor mats.
- Take care when connecting or disconnecting cables. A damaged cable can cause a short in the electrical circuit. Note the polarity and position for later re-installation.
- Prevent damage to the connectors by aligning connector pins before you connect the cable. Misaligned connector pins can cause damage to system components at power-on.
- When disconnecting a cable, always pull on the cable connector or strain-relief loop, not on the cable itself.

Please follow the Pro One disassembly instructions in the MTG TurboCPU installation manual.

2: Installation

Tools and Parts Required for CV

- This manual assumes that a MIDI/Jack Board Rev C or later is already installed in the Pro One.[1]
- You will need a Microchip MCP4728 DAC chip and a daughterboard for it that converts the MSOP10 pinout to a regular 0.3" 10-pin DIP layout. These are readily available and inexpensive.
- Screwdrivers, soldering iron, solder and hook-up wire.

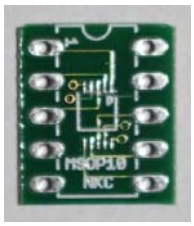
DAC Chip Installation (if required)

Installation of the DAC chip is not difficult but it does require fine soldering and magnification (magnifying glass, loupe, etc.). There are many useful videos on YouTube demonstrating surface mount device soldering.

The Pro One MIDI board is designed to take a 10-pin DIP device. The DAC chip is a very tiny MSOP-10 package. You can buy the chip and adapter board separately or assembled. It is also available as an installed option from MTG for extra charge.

Here are some examples of bare adapter boards (also called breakout boards):

http://www.nkcelectronics.com/msop10-to-dip-adapter-101010.html



http://www.ebay.com/itm/3-Pcs-SMD-CONVERTER-ADAPTER-PCB-MSOP8-MSOP10-0-5-mm-/120750047844

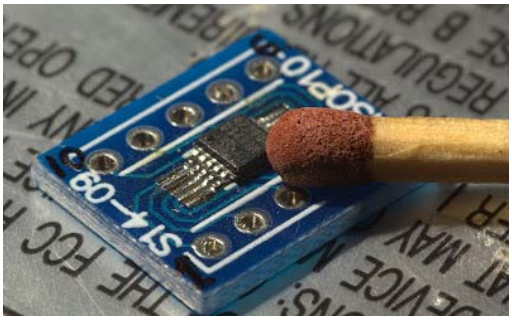
Finally, you can purchase a complete daughterboard here:

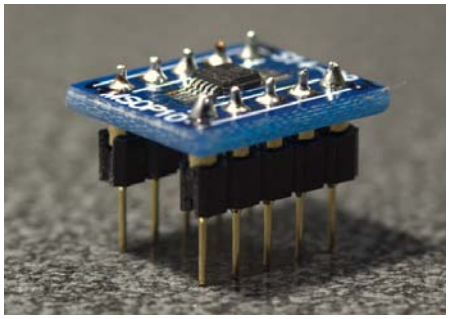
[1] If you are using an older version of the Pro One MIDI board, or have constructed your own MIDI interface circuit, contact MTG for instructions on adding do-it-yourself CV circuitry.

http://www.proto-advantage.com/store/p/MCP4728_Breakout_Board.php?gclid=CKyByJrNk78CFZJbfgodBA4AkQ

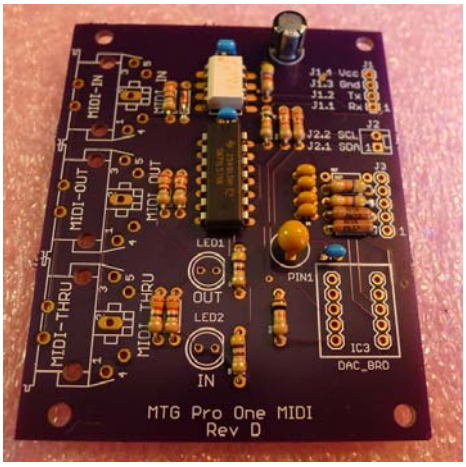
If you are soldering the DAC yourself, the most important points are to observe pin 1 orientation and to clean up any accidental solder bridges with (static free) SolderWick.

Pin 1

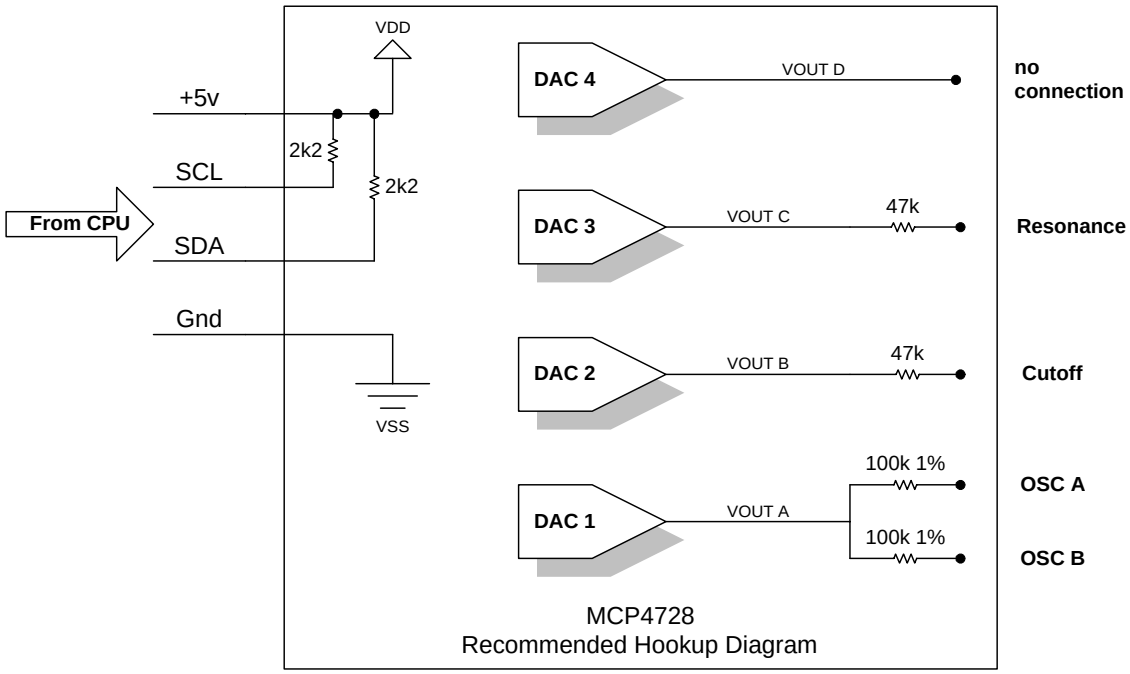




Once you have a properly soldered daughterboard, it is a simple procedure to install it on the MIDI board. You can use toothpicks to elevate the daughterboard off of the MIDI board during soldering. Or use a socket trimmed to 10 pins.



Wiring Block Diagram



DAC Wiring Summary

Make sure the MIDI interface is functional before you begin the DAC hook-up. Later you may need to update the firmware to include support for the CV functionality. Power connections +5v and Gnd are shown for completeness.

You will need to solder wires on the TurboCPU, the MIDI jack board and the Pro One main board. If you have not done so already, disassemble the Pro One as described in the TurboCPU Installation Guide.

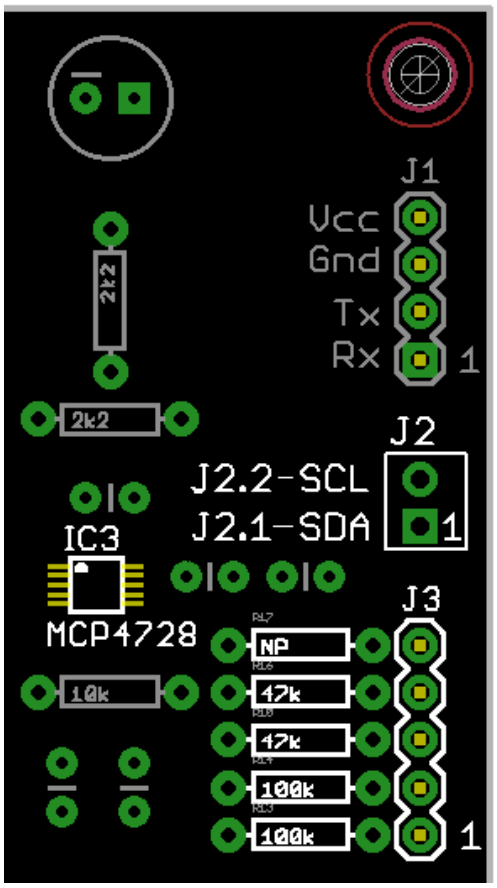
1. Hook up SCL and SDA signals from the Turbo CPU to the v2 MIDI board.

2. Connect two wires from VOUT_A to the CV summing points for OSC A and OSC B.

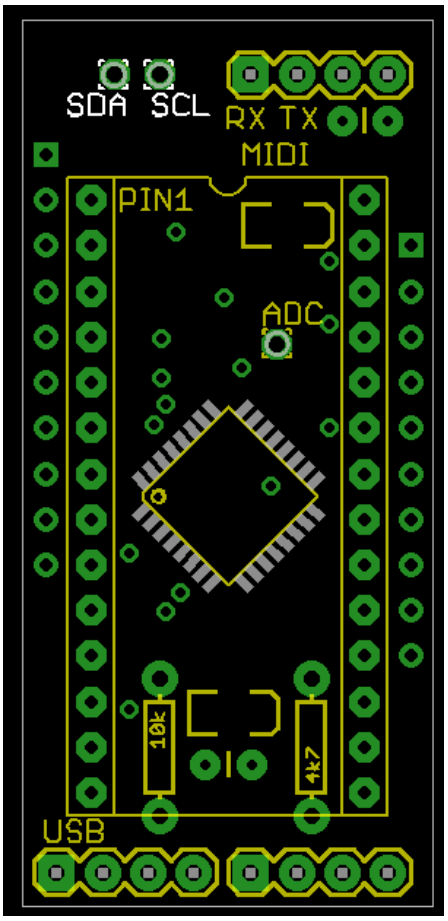
3. Connect a wire from VOUT_B to the CV summing point for the Filter Cutoff.

4. Connect a wire from VOUT_C to the Filter Resonance chip.

Step 1. CPU-to-CV Hookup



Jack Board (DAC area)



CPU Board

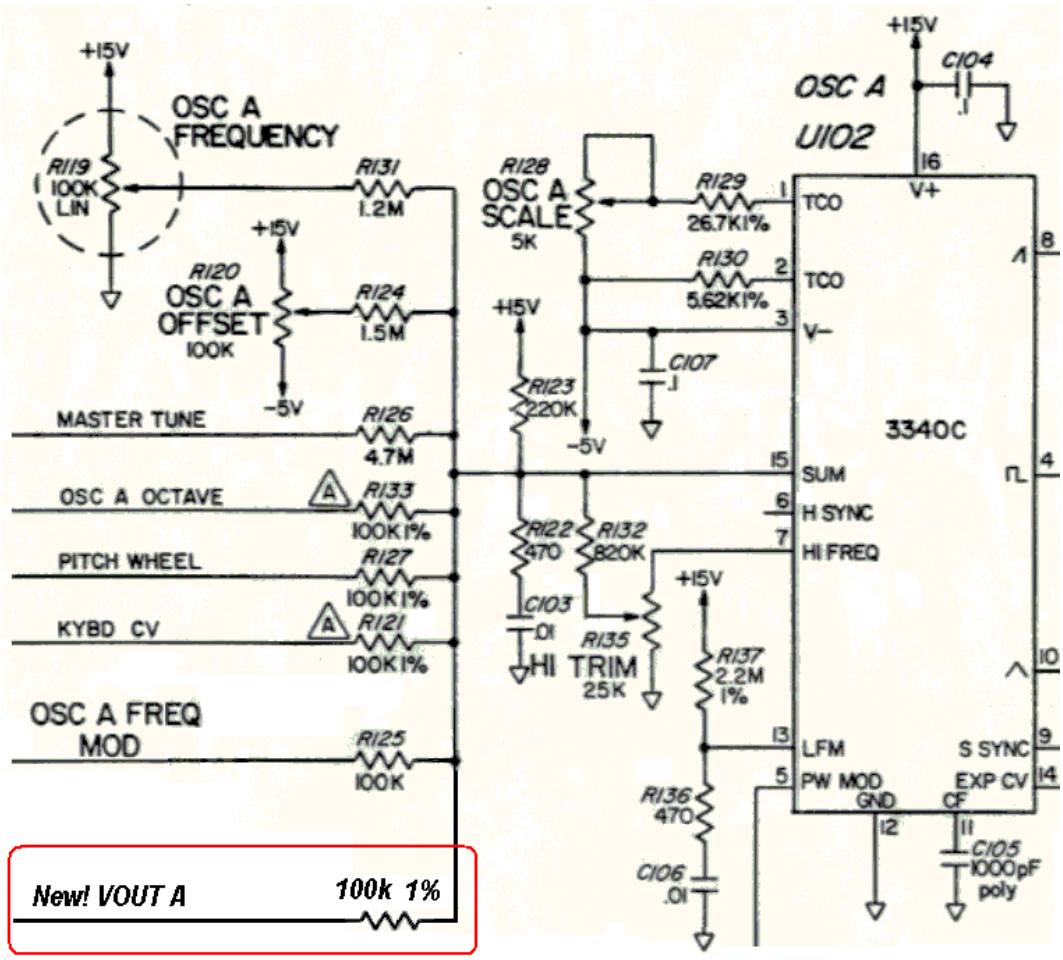
When you connected the MIDI wiring, you connected +5v, ground, MIDI Rx and MIDI Tx. All that remains on the CPU connection side are the two DAC I2C control lines SCL and SDA (see the diagram above).

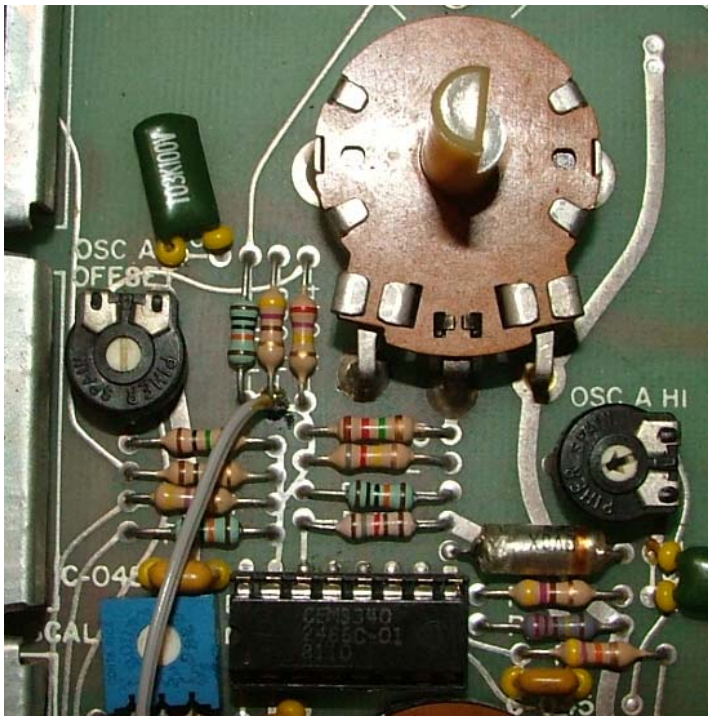
On the Turbo CPU module locate the two points for attaching to SDA and SCL. Solder two wires onto the Turbo CPU module and connect them directly to the corresponding pins on the v2 MIDI Jack Board at header J2.

Step 2. OSC A and OSC B

CV1: $VOUT_A$ to OSC A

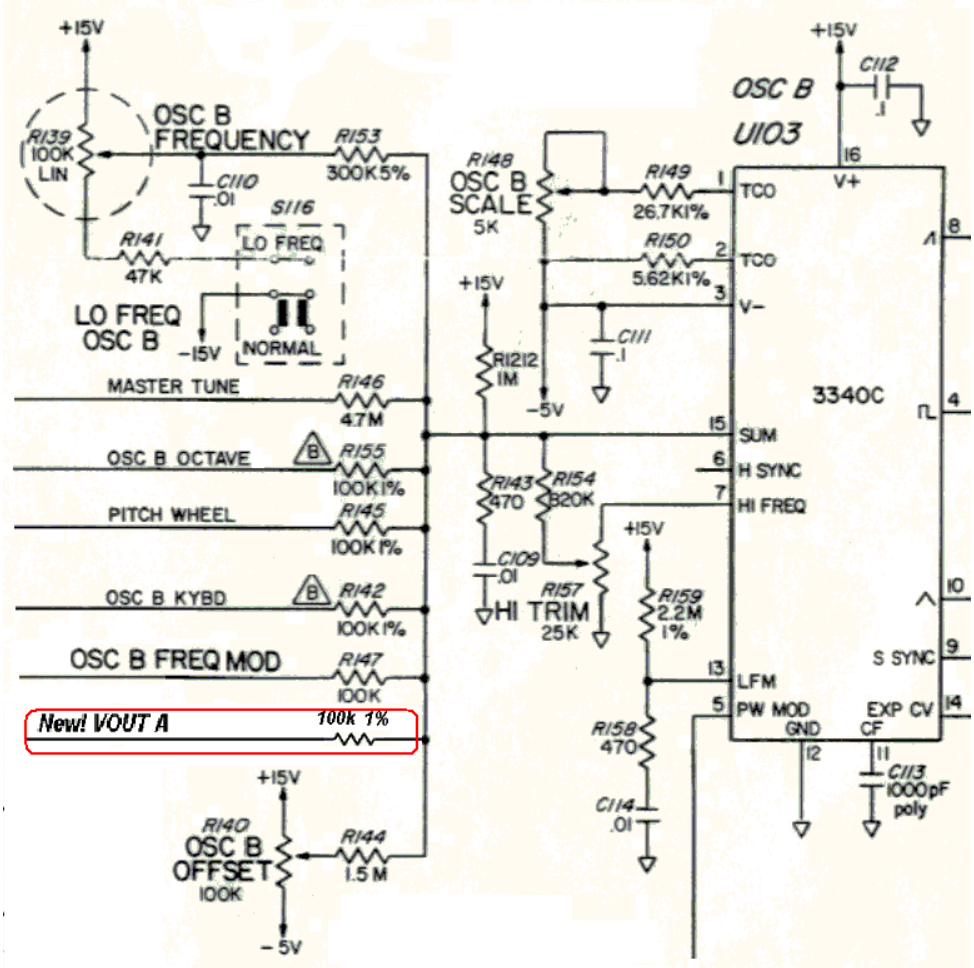
Using only a wire connect J3 pin 1 (CV1 or $VOUT_A$) **to OSC A on the Pro One**. The 100k 1% metal film resistor shown is already installed on the MIDI jack PCB.

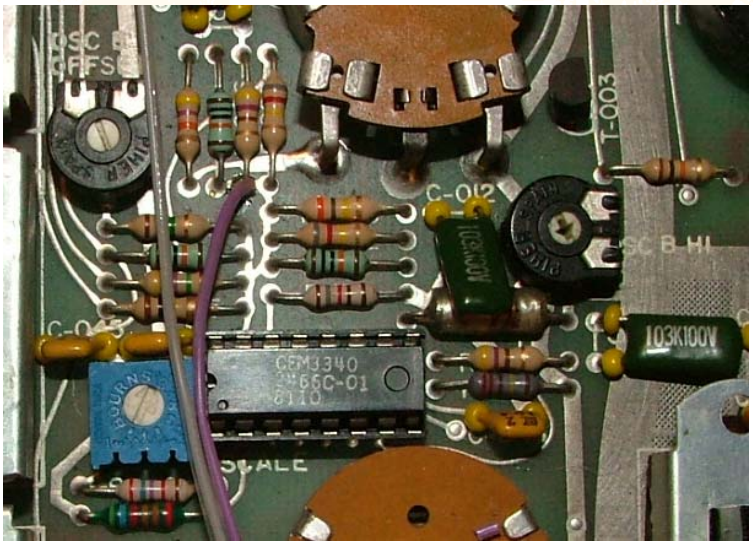

+15V
OSC A FREQUENCY
RI19 100K LIN
RI31 1.2M
+15V
RI20 OSC A OFFSET 100K
RI24 1.5M
-5V
MASTER TUNE
RI26 4.7M
OSC A OCTAVE
RI33 100K 1%
PITCH WHEEL
RI27 100K 1%
KYBD CV
RI21 100K 1%
OSC A FREQ MOD
RI25 100K
New! VOUT A
100k 1%
RI28 OSC A SCALE 5K
RI29 26.7K 1%
RI30 5.62K 1%
+15V
RI23 220K
-5V
CI07
RI22 470
RI32 820K
CI03 .01
HI TRIM
RI35 25K
+15V
RI37 2.2M 1%
RI36 470
CI06 .01
OSC A U102
CI04 .1
16 V+
1 TCO
2 TCO
3 V-
15 SUM
6 H SYNC
7 HI FREQ
13 LFM
5 PW MOD
12 GND
11 CF
8
4
10
9 S SYNC
14 EXP CV
CI05 1000pF poly
3340C


OSC A HI

CV1: $VOUT_A$ to OSC B

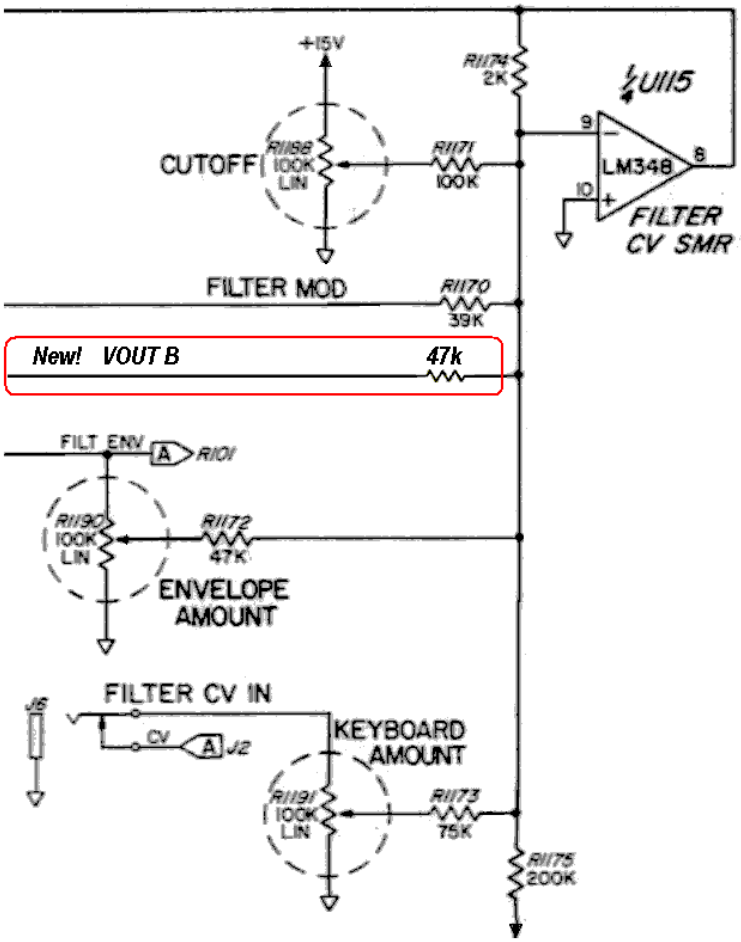
Using another wire connect J3 pin 2 (CV1 or $VOUT_A$) **to OSC B on the Pro One**. The 100k 1% metal film resistor shown is already installed on the MIDI jack PCB. *Yes, it's the same CV, but a different wire from a different resistor!*

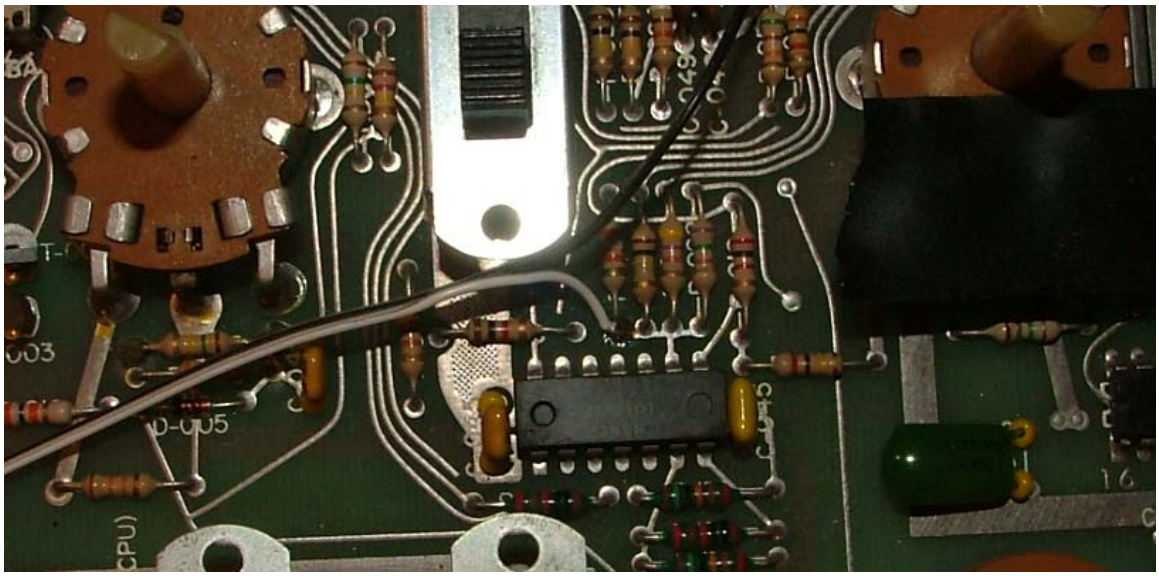




Step 3. CV2: $VOUT_B$ to Filter Cutoff

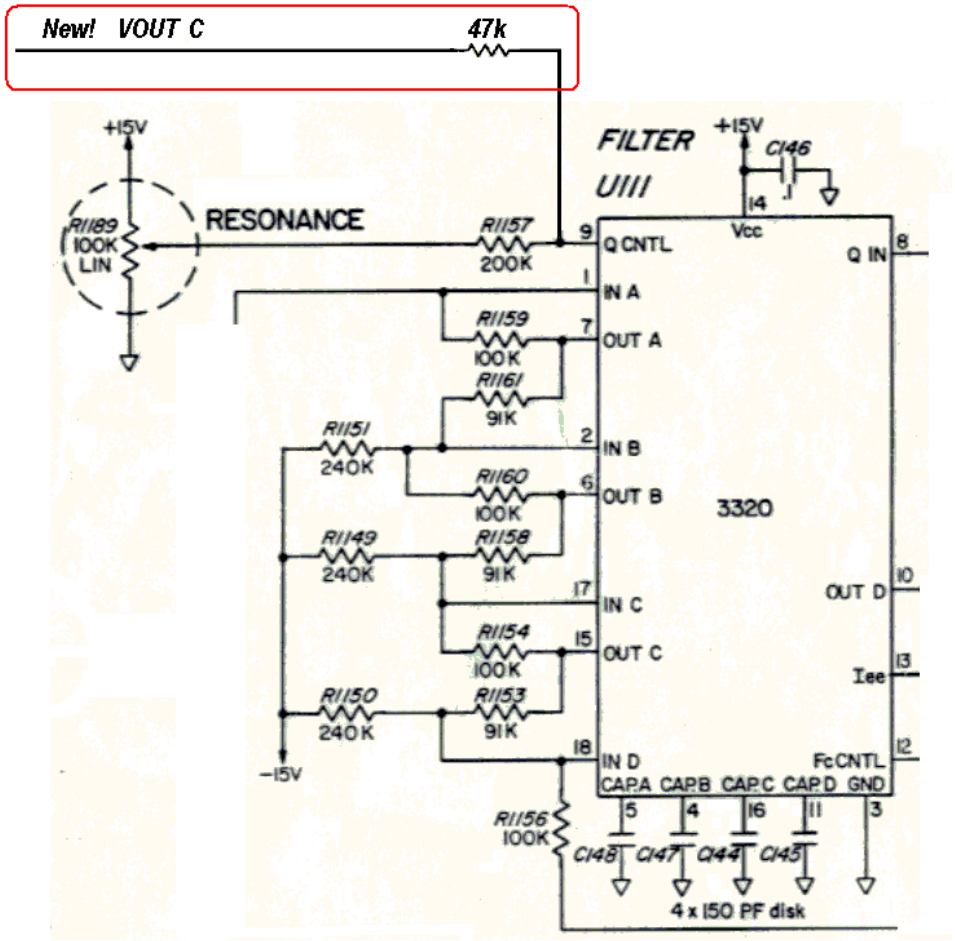
Using another wire, connect CV2 (VOUT B) to the Filter Cutoff summing point. The 47k resistor shown is already installed on the MIDI jack PCB.

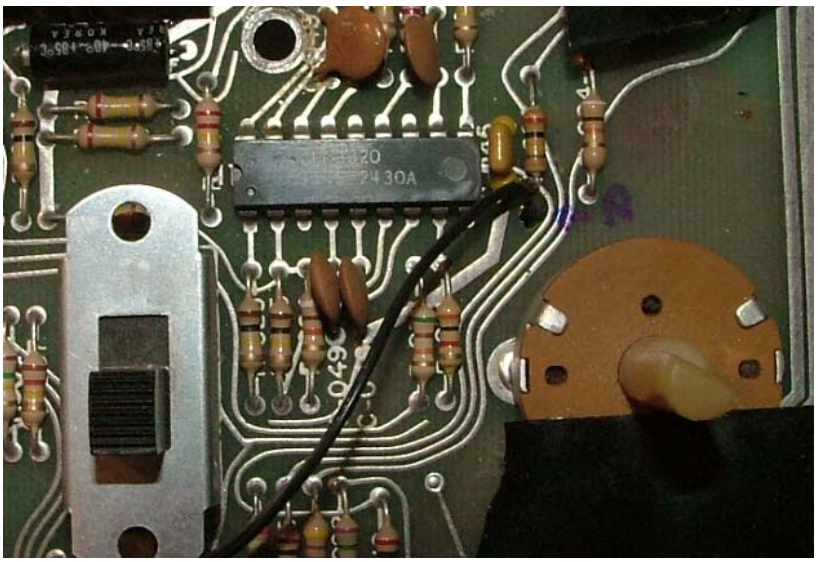




Step 4. CV3: VOUT$_C$ to Filter Resonance

Using another wire, connect CV3 (VOUT C) to the Filter Resonance pin. The 47k resistor shown is already installed on the MIDI jack PCB.





3: Using the CV/DAC Option

Once the wiring is complete, reassemble the Pro One.

The operating information for the CV/DAC option is located in Chapter 3 of the TurboCPU User Guide.

Additional MIDI information is located in the appendix of that document as well.

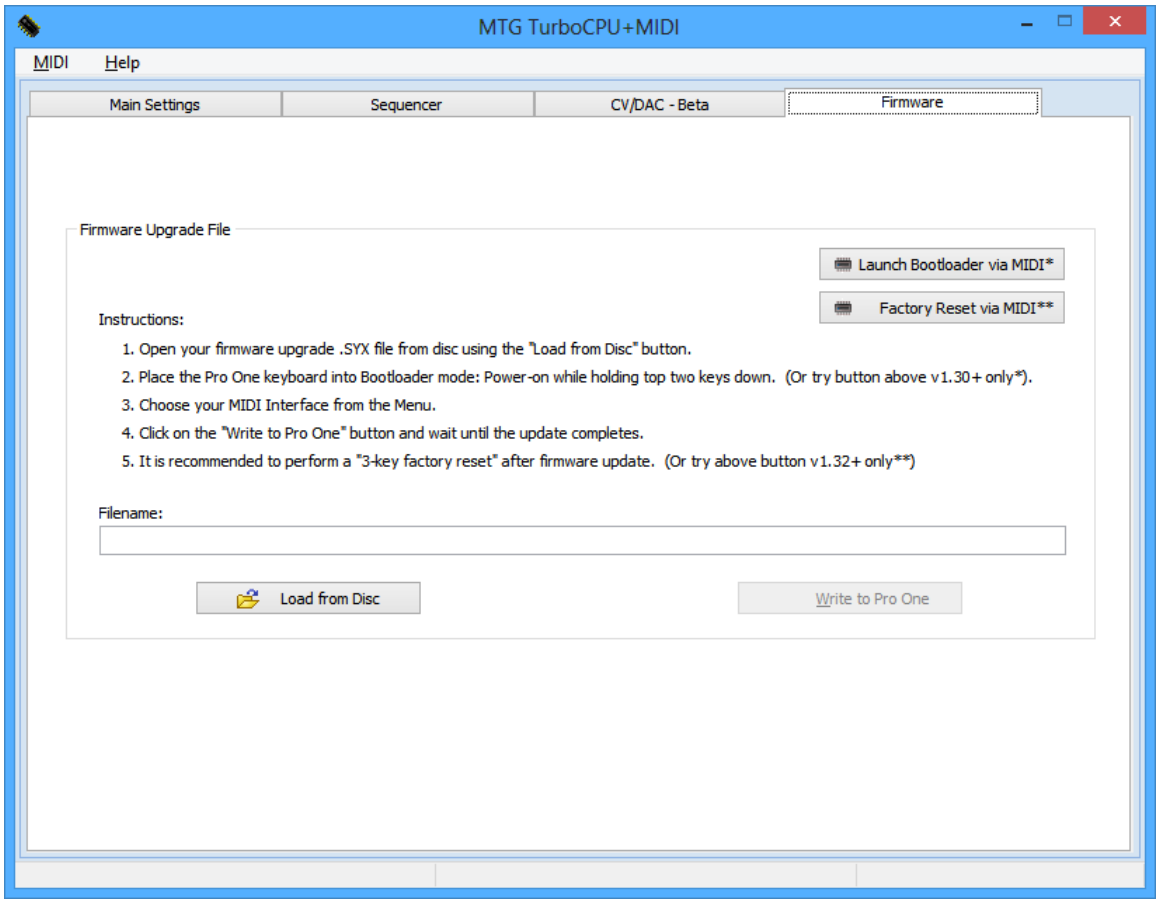
Appendix A: Firmware Upgrade using the PC App

DO ONLY IF NEEDED. The CV functionality requires firmware v1.11 or later. Obtain the latest firmware in .SYX format from the MusicTechnologiesGroup.com website. This section assumes you have installed the TurboCPU.exe Windows application. More information about the application is available in the User Guide.

You may lose your sequencer data and user parameters as a result of a firmware upgrade. The Windows™ PC application will allow you to back this data up to your PC if you wish.

With your Pro One attached to your MIDI interface and turned on, launch the Windows PC program. From the MIDI (select/open) menu choose the correct MIDI IN device and the correct MIDI OUT device. If the software can communicate with the TurboCPU you may proceed.

Select the Firmware tab in the application.



If your Pro One is not in Bootloader mode, then you need to do that now. If your TurboCPU is v1.30 or newer you can click the provided **Launch Bootloader via MIDI** button. Otherwise launch the bootloader using manual power-on method.

> To launch the bootloader manually, start with the Pro One turned off. Hold the two highest notes down (B2 and C3, keys 36 and 37). While holding them down, power on the Pro One. The bootloader will emit several short notes. After that the bootloader remains in control of the synth.

Use the **Load from Disc** button to locate the .SYX firmware file by browsing your PC for the file you downloaded. Once the file is loaded, the upgrade automatically starts. Do not disturb the process until it is complete (about 30 seconds).

After a few moments the firmware update will finish. It is recommended that you perform a Factory Reset at this time to load the default settings. You should be able to use the **Factory Reset via MIDI** button if your new firmware version is v1.32 or newer. Reload your settings and/or sequence data if you like.

Appendix B: Firmware Upgrade using MIDIOX

DO ONLY IF NEEDED. The CV functionality requires firmware v1.11 or later. Obtain the latest firmware in .SYX format from the MusicTechnologiesGroup.com website. We show the process using MIDIOX, but you should be able to use any similar program.

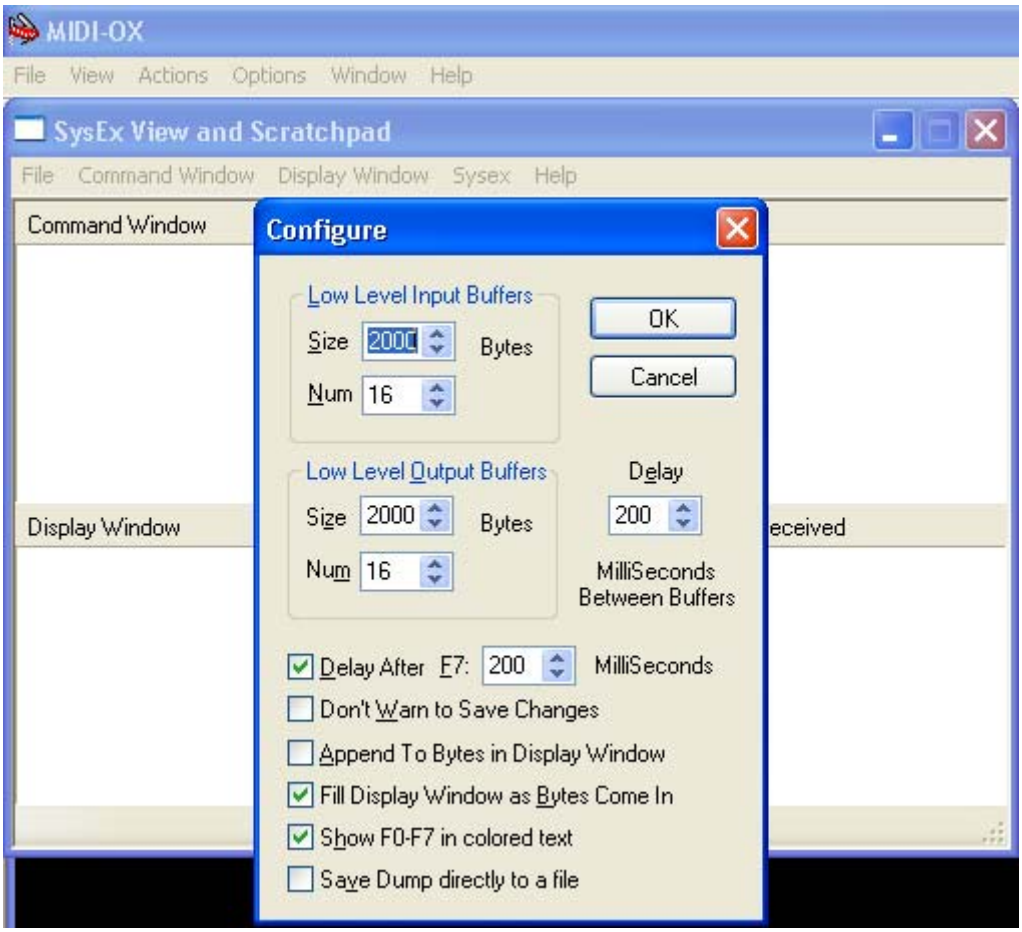
You may lose your sequencer data and user parameters as a result of a firmware upgrade.

Configure MIDIOX

Set the Sys Ex properties of MIDIOX by clicking:

`View->SysEx...` and then `SysEx->Configure`

Use the minimum recommended setting shown here:



Prepare the Pro One for Download

Hook up the MIDI connections to your computer and to the Pro One. Launch the Pro One in bootloader mode by turning off the Pro One, holding the two highest keys (B2 and C3) and then while holding those keys down, turning the Pro One on. You should hear several short notes that indicate the MIDI bootloader program is in control.

Test the Communication

If you send a Universal Device Inquiry system exclusive packet to the Pro One, it will respond with the MidiLoader version packet. In MIDIOX, click:

`View->SysEx...`

Then from the SysEx menu click

`Command Window->Load File...`

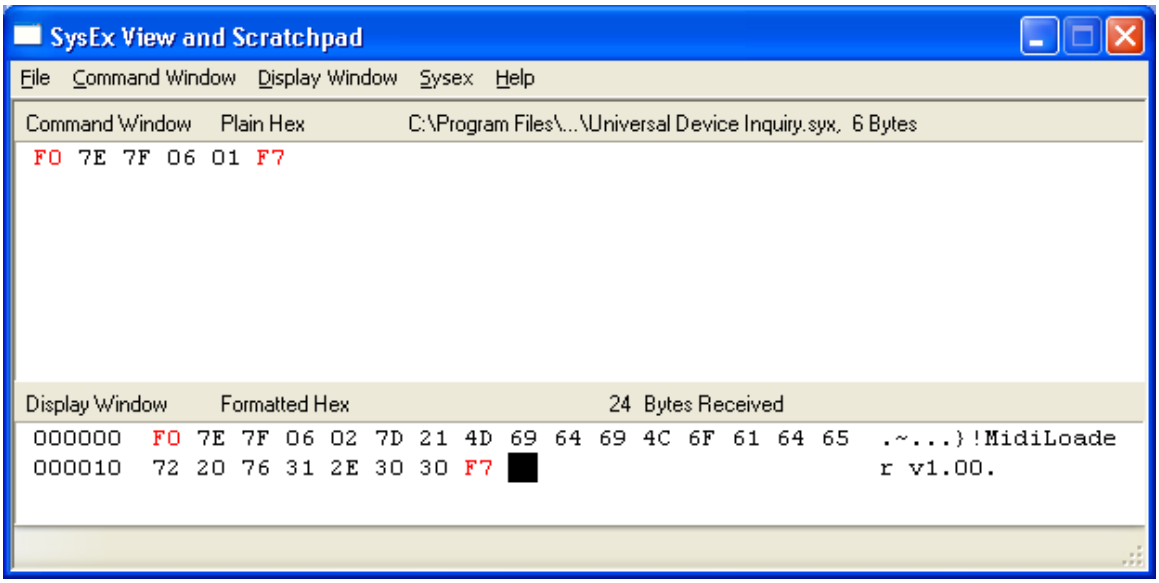
Choose the file **`Universal Device Inquiry.syx`** and click **open**. Click

`Command Window->Send/Receive Sysex`

The Pro One bootloader will respond with 24 bytes. Click on **Done**. Next click on

`Display Window->Hex View Swap`

You may have to enlarge the window a little, but you should see something like:



The message must say **MidiLoader** not **ProOne CPU**! If it does, you have not launched the bootloader properly. Repeat the above steps carefully. Once you verify the MidiLoader message you can proceed with the firmware upgrade.

Firmware Upgrade

Close the SysEx View window and open it again to get an empty window. If you are prompted to save anything, click **No**. Open the new firmware file by clicking

```
Command Window->Load File...
```

Choose the file required for the upgrade (E.g. `ProOne_v2_00.syx`). You should see that a fairly large file is opened. Click on

```
Command Window->Send/Receive Sysex
```

The upgrade takes approximately 30 seconds. Do not touch the computer or Pro One during this time. At the end of the upgrade the Pro One will reboot. Also the MIDIOX screen will show a fairly large number of transactions. You can close MIDIOX (don't save anything) and begin using the updated Pro One.

If the Pro One doesn't reboot, verify that the Pro One is operational. If not, repeat the download.

You are advised to perform an MTG Factory Defaults procedure on a newly reflashed CPU. This will wipe your settings, but it prevents the CPU from operating in an unstable state.